Evaluation of a Faculty Development Program Aimed at Increasing Residents' Active Learning in Lectures

Bonnie C. Desselle, MD
Robin English, MD
George Hescock, MD
Andrea Hauser, MD
Melissa Roy, MD
Tong Yang, MD, MS
Sheila W. Chauvin, PhD, MEd

Abstract

Background Active engagement in the learning process is important to enhance learners' knowledge acquisition and retention and the development of their thinking skills. This study evaluated whether a 1-hour faculty development workshop increased the use of active teaching strategies and enhanced residents' active learning and thinking.

Methods Faculty teaching in a pediatrics residency participated in a 1-hour workshop (intervention) approximately 1 month before a scheduled lecture. Participants' responses to a preworkshop/postworkshop questionnaire targeted self-efficacy (confidence) for facilitating active learning and thinking and providing feedback about workshop quality. Trained observers assessed each lecture (3-month baseline phase and 3-month intervention phase) using an 8-item scale for use of active learning strategies and a 7-item scale for residents' engagement in active learning. Observers also assessed lecturer-resident interactions and the extent to which residents were asked to justify their answers.

Results Responses to the workshop questionnaire (n = 32/34; 94%) demonstrated effectiveness and increased confidence. Faculty in the intervention phase demonstrated increased use of interactive teaching strategies for 6 items, with 5 reaching statistical significance ($P \leq .01$). Residents' active learning behaviors in lectures were higher in the intervention arm for all 7 items, with 5 reaching statistical significance. Faculty in the intervention group demonstrated increased use of higher-order questioning ($P = .02$) and solicited justifications for answers ($P = .01$).

Conclusion A 1-hour faculty development program increased faculty use of active learning strategies and residents' engagement in active learning during resident core curriculum lectures.

Editor's note: The online version of this article contains a table that describes the overview of the educational program, the presession/postsession questionnaire, a list of helpful hints for creation of interactive lectures, slides on the creation of an active learning environment in the lecture setting, a workshop creation worksheet, worksheet cases and questions, and the direct observation instrument used in this study.

All authors are at Louisiana State University Health Sciences Center. All authors but Yang and Chauvin are also at Children's Hospital. **Bonnie C. Desselle, MD,** is Associate Professor of Pediatrics and Program Director of the Pediatric Residency Program; **Robin English, MD,** is Associate Professor of Pediatrics, and Director of Clinical Sciences Curriculum; **George Hescock, MD,** is Assistant Professor of Pediatrics and Associate Program Director of Pediatric Residency Program; at the time of writing, **Andrea Hauser, MD,** was Assistant Professor of Pediatrics at Louisiana State University Health Sciences Center; she is now Assistant Professor of Pediatrics at Baylor College of Medicine and Hospitalist at Texas Children's Hospital; **Melissa Roy, MD,** is Assistant Professor of Pediatrics; **Tong Yang, MD, MS,** is Measurement Consultant in the Office of Medical Education Research and Development; and **Sheila W. Chauvin, PhD, MEd,** is Director of the Office of Medical Education Research and Development, Professor of Medicine in Internal Medicine, and Professor in the School of Public Health.

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Corresponding author: Bonnie C. Desselle, MD, Department of Pediatrics, Louisiana State University Health Sciences Center, 200 Henry Clay Avenue, Children's Hospital, New Orleans, LA 70118, 504.896.9263, bdesse@lsuhsc.edu

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Background

The Accreditation Council for Graduate Medical Education (ACGME) requires that all residents receive regularly scheduled didactic sessions.[1] Didactic sessions are frequently accomplished in large group lectures, in which the lecturer is often the only active participant and imparts information to passive resident learners.[2] Higher education experts encourage active engagement in the learning process, even in lectures, to enhance knowledge acquisition and retention and the development of thinking skills[3–5] and have stimulated the integration of active learning techniques into medical student education[6–8] and other professional disciplines.[9] However, evidence regarding the use of active learning techniques in graduate medical education

(GME) is lacking. Because GME emphasizes residents' application of knowledge and development of clinical diagnostic reasoning and critical thinking skills, the simple transmission of facts in lectures has limited value for their professional development.[4,10]

In the pediatrics residency program at Louisiana State University Health Sciences Center–New Orleans, we created a faculty development program aimed at increasing faculty use of active learning strategies in the core lecture series to enhance residents' engagement in learning and thinking. Prior studies supported faculty development in the increased use of such strategies,[11] and we tested its effect in the GME setting. We hypothesized that participation in a 1-hour faculty development workshop would result in greater use of active learning strategies and residents' active learning, as measured by observations of baseline (no workshop) and intervention (workshop participants) lectures.

Methods

Research Design

This study design of the program evaluation included baseline and intervention phases and was grounded in Kirkpatrick training evaluation framework[12]: level 1, reaction (eg, satisfaction with the workshop); level 2, learning (eg, change in knowledge, attitudes); level 3, behavior change (eg, faculty members' use of skills learned); and level 4, results/effect (eg, residents' engagement in active learning).[13] Approval for the study was obtained from the Louisiana State University Health Sciences Center–New Orleans Institutional Review Board.

Participants

Participants included Department of Pediatrics faculty who teach in the core lecture series and residents who attended these sessions. The lecture series consisted of 1-hour instruction held at noon, typically 3 times weekly at a university-affiliated, free-standing children's hospital. Each faculty member conducted a lecture for approximately 35 learners. Learners comprised pediatric residents, internal medicine-pediatric residents, and medical students rotating on the pediatrics service. Teaching faculty who were not members of the Pediatrics department (eg, pediatric dentistry) were excluded from the study because logistic features would have prevented them from participating in the workshop.

Intervention: Faculty Development Workshop

The pediatrics department specialty divisions whose members were scheduled to teach in the core lecture series during the intervention phase were informed about the initiative to incorporate active learning into lectures. Their faculty members were invited to participate in a 1-hour faculty development workshop approximately 1 month before their scheduled lectures. All workshops were conducted by the first author (B.C.D.), and each faculty member participated in 1 workshop. Workshop content and format was guided by a review of the literature,[3–5,9–10,14] and is provided as online supplemental information. The number of participants in each workshop ranged from 2 to 7.

Instrumentation

Workshop Questionnaire We designed an 11-question presession/postsession questionnaire (also provided as online supplemental material). The instrument uses a 5-point scale to address Kirkpatrick evaluation levels 1 and 2. We evaluated workshop quality (level 1) with items reflecting features of effective learning environments (1 = definitely no, 5 = definitely yes) and level 2 (learning) with items targeting self-perceived confidence to use active learning strategies, based on workshop content (1 = definitely not confident, 5 = definitely confident).

Direct Observation of Lectures Direct observation of lectures targeted Kirkpatrick evaluation levels 3 (behavior) and 4 (results). Review of the literature did not yield instruments that could be used or adapted for our study, and we drew on the literature to design an instrument.[4,5,10,15] The instrument underwent multiple reviews, comment sessions, and pilot testing and is provided as online supplemental material. The instrument assessed (1) faculty use of active learning strategies (8 items), (2) residents' engagement in active learning (7 items) using a dichotomous rating scale (1 = no/not observed, 2 = yes/observed), (3) the quality of the teacher-learner interaction (1 = no questions asked, 5 = almost all thought-provoking questions), and (4) extent to which residents were asked to justify their answers (1 = not at all, 5 = done very well).

Five observers (authors B.C.D., R.E., G.H., A.H., M.R.), who were not blinded to the study question, were trained until sufficient interrater reliability and consistent rater rationale for assessments were achieved.

Data Collection

Participants in the faculty development workshop voluntarily completed the preworkshop/postworkshop questionnaire immediately before and after the session. The preworkshop and postworkshop forms each were composed of 1 side of a single, double-sided sheet, affording matched individual responses while ensuring anonymity.

Two trained observers attended the lectures without prior announcement and assessed them using the observation-based instrument. Observations completed from January to March

2010 were used as baseline data representing lecture practices before implementation of workshop intervention. Observations completed April to June 2010 produced the intervention data.

The lecturers in the baseline phase were unaware of the study and the use of unannounced observers in lectures to facilitate accurate baseline assessment. All lecturers in the intervention phase were informed about the study and the desire for promoting active learner engagement, but they did not receive a copy of the assessment instrument.

Data Analysis

To evaluate the quality of the workshop intervention, data for baseline and intervention lectures were examined and descriptive statistics were completed before inferential statistical analyses. Interrater reliability (κ) was calculated for the direct observation data. Observation-based preworkshop and postworkshop differences were examined using a χ^2 test for dichotomous data, a Wilcoxon signed-rank test for ordinal data, a *t* test for data from Likert-type items,[16] and a Cramer φ for the effect size.[17] Statistical significance was set at $P \leq .05$ for all analyses.

Results

Workshop Effectiveness

The analysis includes data from 32 of 34 workshop participants (94% response rate). Results of paired *t* test revealed statistically significant gains ($P \leq .001$) for 4 of the 6 items (67%): (1) developing higher-order questions, (2) implementing activities for active learning, (3) engaging residents in solving patient cases, and (4) asking residents to justify their interpretations and medical decisions. Results of postworkshop-only quality items (5-point Likert type scale, 1 = definitely no, 5 = definitely yes) revealed item mean scores ranging from 4.78 (*Learning objectives were clear*) to 4.94 (*I had sufficient opportunities to ask questions*).

Lecture Observations

Data were obtained for 21 baseline lectures (given by 16 individuals) and 20 lectures in the intervention phase (given by 18 lecturers). All 21 baseline-phase lectures (100%) were observed by 2 trained observers, and 18 of 20 (90%) intervention-phase lectures by workshop participants were assessed by 2 direct observers, 1 (5%) was assessed by a single observer, and 1 (5%) was not observed. The κ coefficient for interrater reliability was $r = 0.78$.

Observed Faculty and Resident Behavior Changes in Lectures

Statistically significant gains were observed for 5 of 8 faculty teaching behaviors (63%) targeting active learning strategies (TABLE 1). Ratings for intervention lectures for these 5 items were ≥ 20 percentage points higher than baseline-phase lectures. Ratings of resident behaviors (bottom of TABLE 1) showed gains for all 7 items (100%), with 5 (71%) achieving statistical significance. Increases in percentage points for these items ranged from 33.2 to 52.8, and the corresponding effect indices suggest that the improvements had practical significance (TABLE 1).

Positive and statistically significant differences were observed in lecturers' use of questioning ($P = .02$, TABLE 2), with a clear shift from lower-order to higher-order levels. The greatest gain was observed for "mostly fact based and some thought provoking" questions. A statistically significant gain was achieved for the measure assessing whether lecturers asked residents to "justify or explain their answers." However, overall performance remained low, even after workshop participation (1 = not done at all, 5 = done very well; baseline = 1.67, intervention = 2.35, $P = .01$).

Discussion

We evaluated the effect of a 1-hour active learning workshop on faculty teaching and resident learning behaviors, using direct observation to examine the effectiveness of the intervention at all 4 levels of Kirkpatrick training evaluation framework.[12,13] The high ratings for workshop quality and the statistically significant preworkshop/postworkshop gains observed for enhancing faculty confidence supported the 1-hour format (level 1 and 2), although prior studies had used workshops lasting several hours.[11,15] Meaningful gains in faculty teaching behaviors demonstrated transfer from training to real-life practice (level 3), and the gains in resident active-learning behaviors during lectures demonstrated clear, positive effects of the intervention (level 4).

Our findings demonstrated that a brief faculty development intervention can achieve desired changes in faculty teaching and resident learning behaviors that may enhance residents' clinical reasoning and problem solving. Some interactive techniques were not used following the intervention (eg, audience response system and role play), most likely because of barriers including inexperience, lack of preparation time, and/or the ability to use these tools in a 1-hour lecture.

We sought to enhance residents' thinking skills through improving faculty members' questioning strategies.[15] Although faculty asked questions in the baseline lectures, the significant gains shown in TABLE 2 confirmed faculty participation in the workshops increased the frequency and type of questions faculty asked during intervention lectures. The use of higher-order questions facilitated a substantial shift from one-way transmission of information to modeling and facilitated interaction, active learning, and higher-order thinking.

TABLE 1 **Interactive Techniques and Active Learning Behaviors Observed During Baseline and Intervention Phase Lectures**

Techniques and Behaviors	Baseline-Phase Lectures, %, n = 21[a]	Intervention-Phase Lectures by Workshop Participants, %, n = 19[a]	χ^2 Test[b]	*P* Value	Effect Size[c]
Interactive techniques used					
Questioning of audience	73.8	94.6	6.18	.01	0.39
Solving cases	40.5	78.4	11.61	<.001	0.54
Completing worksheet	0.0	27.0	13.00	<.001	0.57
Audience asking the lecturer questions	4.8	25.0	6.55	.01	0.40
Working in pairs or groups	2.4	27.0	9.97	<.001	0.50
Using audience response system	0.0	0.0	n/a	n/a	n/a
Using simulation/role play	0.0	0.0	n/a	n/a	n/a
Answering a written quiz	0.0	5.4	2.33	.13	0.24
Observed resident-active learning behaviors					
Developing problem definition	9.8	43.0	12.95	<.001	0.57
Applying basic science	9.8	54.1	17.92	<.001	0.67
Interpreting data	31.0	83.8	22.25	<.001	0.75
Reaching diagnosis	33.3	78.4	16.09	<.001	0.63
Solving case vignette	47.5	78.4	7.81	.01	0.44
Creating patient management plans	40.5	46.0	0.24	.62	0.08
Obtaining data	34.2	51.4	2.36	.10	0.24

Abbreviation: n/a, not applicable.

[a] Data were available for all baseline lectures (n = 21) and for 19 of the 20 intervention-phase lectures (95%) presented by workshop participants.
[b] Degrees of freedom of 2 × 2 χ^2 = 1.
[c] Cramer φ or V used (small effect = 0.1; moderate effect = 0.3; large effect = 0.5).

TABLE 2 **Summary of Observer Ratings for Lecturers' Use of Questioning[a]**

	Level of Questioning				
	Lower-Order Questioning ⟶ Higher-Order Questioning				
Group	No Question Asked, %	Only Rhetorical Questions Asked, %	Only Fact-Based Questions Asked, %	Mostly Fact-Based, Some Thought-Provoking Questions Asked, %	Almost All Thought-Provoking Questions Asked, %
Baseline phase, n = 21	21.4	9.5	28.6	33.3	7.1
Intervention phase, n = 19	5.4	0.0	21.6	59.5	13.5

[a] Wilcoxon signed-rank test for baseline versus intervention-phase lectures (workshop participants only): *P* = .02.

We also identified opportunities for future faculty development (eg, soliciting justifications and explanations for resident answers). Future work will target the extent to which improvements in the core lectures can be sustained, built on, and transferred to other settings, such as bedside teaching, and whether active learning strategies (such as the use of an audience response system) have a positive effect on knowledge retention, as has been found in other studies.[18,19]

Our study has several limitations. They include a single-program intervention, limiting generalizability; voluntary workshop participation, which may result in selection bias; faculty behaviors that may be influenced by the presence of observers (a Hawthorne effect)[20]; and observers who were not blinded to the purpose of the study, introducing the potential for observer bias.

Conclusion

A 1-hour faculty development program increased faculty use of active learning strategies and residents' engagement in active learning during resident core curriculum lectures. Our results are encouraging and suggest that this faculty development intervention could be used to benefit other GME programs.

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